

What is claimed is:

1. A controller for an injector of the type having a motor which advances and retracts a plunger located within a syringe housing toward and away from a nozzle located on the front of the syringe to inject fluid into or out of an animal subject, comprising:

a manual movement switch which generates an electrical signal in response to actuation by an operator, and

a control circuit responsive to said electrical signal, said control circuit causing said motor to move said plunger when said switch is actuated by the operator, and, in a normal mode of operation, causing said motor to cease moving said plunger when said switch is released by the operator, wherein

said control circuit includes a locking mode of operation in response to specific operator activity, and, in said locking mode of operation, said control circuit causes said motor to continue motion of said plunger regardless of whether said switch is released by the operator.

2. The controller of claim 1 wherein said control circuit enters said locking mode of operation when said manual motion switch is actuated for a predetermined period of time.

3. The controller of claim 1 wherein said normal mode of operation is an accelerating mode in which control circuit accelerates the motion of said motor as long as said manual motion switch is actuated, until a predetermined maximum velocity is achieved.

4. The controller of claim 1 further comprising

a second manual movement switch which generates a second electrical signal in response to actuation by an operator, wherein

5 said controller is further responsive to said second electrical signal, and said controller initiates motion of said motor only when both of said manual movement switches are concurrently actuated and generating both of said electrical signals.

10 5. The controller of claim 4 wherein said normal mode of operation maintains said motor at said velocity when either one of said manual movement switches is actuated, and accelerates said motor to a greater velocity when both of said manual movement switches are actuated.

15 6. The controller of claim 5 wherein said normal mode of operation establishes a predetermined maximum velocity beyond which said control circuit will not accelerate said motor.

20 7. The controller of claim 6 wherein said control circuit enters said locked mode when said motor has been accelerated to said predetermined maximum velocity.

25 8. The controller of claim 7 wherein said locking mode of operation includes a safety feature so that, after said controller enters said locked mode and both of said manual switches are released, said control circuit is further responsive to said electrical signals and causes said motor to cease movement if either of said manual switches is thereafter actuated.

30 9. The controller of claim 1 further comprising a visual indicator connected to said control circuit and

actuated by said control circuit to provide visual feedback on the operation of the control circuit.

10. The controller of claim 9 wherein
said control circuit actuates said visual
5 indicator to produce a first visual indication when said control circuit is in said normal mode of operation and a second, visually distinct indication when said control circuit is in said locking mode of operation.

11. The controller of claim 9 wherein
10 said visual indicator is a light mechanically coupled to and moving with said motor, and
said control circuit actuates said light to blink on and off while said motor is moving and to light continuously when said control circuit is in said locking
15 mode.

12. A controller for an injector of the type
having a motor which advances and retracts a plunger
located within a syringe housing toward and away from a
nozzle located in the front of the syringe to inject
20 fluid into or out of an animal subject, adapted for use with syringe assemblies which include an extender attached to said plunger, comprising:

a control circuit which causes said motor to move,
said controller tracking the location of said motor while
25 moving said motor, and

a memory storing an offset value representative of the length of an extender, if any, which is attached to said plunger, wherein

said control circuit computes a value indicative
30 of the location of said plunger within said syringe by applying said stored offset value to the tracked location of said motor, and ceases motion of said plunger when

said computed value indicates that said plunger is at an end of said syringe.

5 13. The controller of claim 12 wherein said control circuit generates and stores said offset value by requesting, from an operator, information sufficient to compute the length of an extender, if any, which is attached to said plunger, deriving said offset value therefrom, and storing the derived offset value.

10 14. The controller of claim 13 wherein said control circuit has a selectable mode in which said control circuit always sets said offset value to a predetermined value, and does not request said information from the operator.

15 15. The controller of claim 12 further comprising a detector located proximate to said syringe for detecting the length of an extender, if any, which is attached to said plunger from physical indicia on the syringe and generating an electrical signal representative of the detected length, wherein
20 said control circuit is responsive to said electrical signal, and generates and stores an offset value corresponding to the detected length represented by said electrical signal.

25 16. A controller for an injector of the type having a motor which advances and retracts a plunger located within a syringe housing toward and away from a nozzle located in the front of the syringe to inject fluid into or out of an animal subject, comprising:
30 a manual movement control which generates one or more electrical signals in response to actuation by an operator, said electrical signals indicating a desired

velocity of manual motion, said control capable of
indicating different desired manual motion velocities
with said electrical signals in response to different
actuations of said manual movement controls by said
5 operator, and

a control circuit responsive to said electrical
signals, said controller causing said motor to move said
plunger at a velocity indicated by said electrical
signals.

10 17. The controller of claim 16 wherein
said manual movement control comprises a rotary
switch which, when rotated, generates a series of
electrical signals representative of the velocity of
rotation of said switch, wherein

15 said control circuit is responsive to said series
of electrical signals and causes said motor to move said
plunger at a velocity proportional to the frequency of
said series of electrical signals.

20 18. The controller of claim 16 wherein
said manual movement control comprises an on/off
switch and one or more programming switches each of which
generates an electrical signal,

25 said control circuit is responsive to actuation of
said programming switches and thereby obtains from the
operator a speed value indicative of desired
responsiveness of said on/off switch, and stores the
obtained speed value, and

30 said control circuit is further responsive to
actuation of said on/off switch, and while said on/off
switch is actuated causes said motor to move said plunger
at a velocity or acceleration derived from said stored
speed value.

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19. A method of controlling an injector of the type having a motor which advances and retracts a plunger located within a syringe housing toward and away from a nozzle located on the front of the syringe to inject fluid into or out of an animal subject, comprising:

providing a manual movement switch which generates an electrical signal in response to actuation by an operator,

causing said motor to move said plunger when said switch is actuated by the operator,

in a normal mode of operation, causing said motor to cease moving said plunger when said switch is released by the operator, and

in a locking mode of operation, causing said motor to continue motion of said plunger regardless of whether said switch is released by the operator.

20. A method of controlling an injector of the type having a motor which advances and retracts a plunger located within a syringe housing toward and away from a nozzle located in the front of the syringe to inject fluid into or out of an animal subject, adapted for use with syringe assemblies which include an extender attached to said plunger, comprising:

storing an offset value representative of the length of an extender, if any, which is attached to said plunger,

causing said motor to move,

tracking the location of said motor while moving said motor,

computing a value indicative of the location of said plunger within said syringe by applying said stored offset value to the tracked location of said motor, and

ceasing motion of said plunger when said computed value indicates that said plunger is at an end of said syringe.

21. A method of controlling an injector of the
5 type having a motor which advances and retracts a plunger located within a syringe housing toward and away from a nozzle located in the front of the syringe to inject fluid into or out of an animal subject, comprising:

providing a manual movement control which
10 generates one or more electrical signals in response to actuation by an operator, said electrical signals indicating a desired velocity of manual motion, said control capable of indicating different desired manual motion velocities with said electrical signals in
15 response to different actuations of said manual movement controls by said operator, and

causing said motor to move said plunger at a velocity indicated by said electrical signals.

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